

OSTEOLOGICAL CHARACTERISTICS OF THE FAMILY
AMPHIPNOIDÆ.

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The genus *Amphipnous* has been generally associated with the typical *Symbranchidæ* in the same family. By Dr. Bleeker it was, indeed, long ago isolated as the representative of a peculiar one (*Pneumobranchoidei*), but even he subsequently reduced it to the rank of a subfamily of his *Synbranchoidæ*. Professor Cope again combined it with *Symbranchus* in his family *Symbranchidæ*, segregating the two in an order (*Holostomi*) contrasting with the *Monopteridæ* constituting his order *Ichthyocephali*. The order *Holostomi* was defined in the following terms:

HOLOSTOMI.

“Epiclavicle suspended to fourth vertebra, post-temporal wanting. Parietals in contact. Mouth bordered by the premaxillaries, which are in contact medially and bounded behind by maxillary. Symplectic present; vertebræ unaltered; no pectoral fin. Third superior pharyngeal not smaller than fourth.

“One family, the *Symbranchidæ*, with the genera *Amphipnous* and *Symbranchus*.”

The “epiclavicle [is not] suspended to fourth vertebra” in the skeleton of *Amphipnous* examined by myself, but is nevertheless free and not “suspended to post-temporal and to cranium” as in the *Ichthyocephali*; *Amphipnous* is therefore doubtless the type of the *Holostomi*. *Symbranchus*, however, has been asserted by all except Professor Cope to have the “humeral arch attached to the skull.” If this is the case, the true *Symbranchidæ* do not belong to the Copean order *Holostomi*, but rather to the *Ichthyocephali*. Possibly Professor Cope based his conclusions on an erroneously named skeleton of *Amphipnous*. At any rate, there appears no reason to doubt that *Symbranchus* actually has the humeral arch connected with the cranium. In such case, *Amphipnous* should be accepted as the representative of a peculiar family, *Amphipnoidæ*. Inasmuch, however, as it agrees in so many characters with the *Symbranchidæ* and *Monopteridæ*, it would appear better to retain all in the same order, in spite of the fact that generally the attachment or freedom of the scapular arch is of ordinal importance.

The characteristics of the *Amphipnoidæ* as a family are as follows :

AMPHIPNOIDÆ.

Synonyms as family names.

- = *Pneumobranchoidei* *Bleeker*, Enum. sp. Piscium Archipel. Ind., p. xxxii, 1856.
- = *Amphipnoidæ* *Gill*, Arrangement Fam. Fishes, p. 20, 1872.
- = *Amphipnoidæ* *Gill*, Standard Nat. Hist., v. 3, p. 100, 1885.
- Anguilliformes* sp. *Cuvier et al.*
- Mutænidæ* gen. *Bonap.*
- Sphagebranchidæ* gen. *Richardson* (1845).
- Anguillares* gen. *Müller* (olim).
- Syubbranchidæ* gen. *Swainson, Müller, et al.*

Synonyms as subfamily names.

- = *Pneumobranchini* *Bleeker*, Atlas Ich. Indes Néerland, t. IV, p. 117, 1864.
- = *Amphipnoina* *Günther*, Cat. Fishes. B. M., v. 8, p. 12, 1870.

DIAGNOSIS.

Holostomous Symbranchians peculiar in the development of a pair of bladders behind the head (one on each side of the nape) receiving a portion of the blood from the branchial artery and with the branchiæ reduced (to laminae on the second branchial arch).

DESCRIPTION.

Body anguilliform, anteriorly subcylindrical, behind compressed, especially in the caudal portion; with the anus far behind in the terminal fourth of the length.

Scales minute, arranged in longitudinal rows.

Lateral line distinct, arched forwards, straight behind.

Head small, ovate-conical, without external prominences.

Eyes within the anterior fourth of the head, directed mostly sideways, of small size.

Nostrils mostly superior; the posterior above the orbit and provided with a valve, the anterior advanced forward on the snout and subcircular.

Jaws well developed; the intermaxillines and supramaxillines connected immovably with each other and with the front of the cranium; *intermaxillines* with a rather broad surface and with projecting processes in front; *supramaxillines* appressed to the upper surface of the intermaxillines forwards and curved upwards and backwards and expanded vertically downwards behind. *Mandible* stout; *dentary* differentiated by its hard compact structure, with its external surface deeply incised for the articular and with its terminal portion expanded upwards into a broad high coronoid process; *articular* long, with a wide cotyloid cavity separated by a considerable interval from the dentary, with an attenuated portion applied to the inner surface of the dentary and fitting into the deep notch of the external wall of the dentary;

angular well developed, forming the posterior border of the mandible and extending into an external notch between the dentary and articular.

Teeth mostly curved, conic or bent backwards, and rather blunt; moderate and uniserial on the jaws except in front, where they extend on a short row on each side of the symphysis of the upper jaw forwards and where they extend in a projecting group in the dentary; enlarged and uniserial on the vomer and palatines.

Lips membranous; the lower reverted over the jaw.

Tongue well developed; free in front and on the sides.

Periorbitals incomplete, the preorbital alone (apparently) being developed; that bone has a wide expanded surface in front and its upper edge united with the external edge of the nasal, while the lower edge is applied to the intermaxilline and its posterior edge about the middle emits a long linguiform process backwards.

Opercular apparatus well developed; *operculum* lamelliform and semihastiform, the upper edge being nearly straight and the lower projecting downwards; *suboperculum* rather wide below and projecting backwards beyond the operculum; *interoperculum* thickened and connected behind with the suboperculum and in front with the angular of the lower jaw; *preoperculum* well developed and closely appressed to the suspensorium; a triangular vacuity intervenes between the operculum, interoperculum, and preoperculum.

Branchiotremes confluent into a single external transverse lunate fissure in the thoracic region.

Branchiostegals six, segregated into two groups; one, of two comparatively slender rays arising from the lateral surface of the ceratohyal near the edge; the other, of four stouter rays arising from a groove hollowed out of the outer surface of the ceratohyal and epihyal.

Dorsalis reduced to a fold on the tail; *caudalis* rudimentary; other fins suppressed.

Branchial apparatus peculiarly modified; branchial arches deflected backwards and with the ceratohyals of the fourth at their tips connected with articular surfaces on the proximal edges of the proscapulæ, and with the arches segregated in two groups, the first and second approximated and the third and fourth approximated and remote from the anterior; with a well developed *glossohyal* and a short hastiform *urohyal*, and only the first basihyal ossified; the *hypohyals* of the first arch normally developed and connected with the basihyal; of the second arch, normal and connecting with each other; of the third shoved out of place sideways, and of the fourth shoved together so that the posterior sides meet in the middle and the bones partly intervene between the preceding hypobranchials of the third arch; *ceratobranchials* of four arches ossified; *epibranchials* of first arch suppressed, of other arches developed and deflected downwards at acute angles with the ceratohyals; of the second arch with a broad base, corresponding to the expanded tip of the ceratohyal; of the third and fourth arches

comparatively long and slender; *pharyngobranchials* of third and fourth arches developed as dentigerous *epipharyngeals*, which are closely apposed to each other and of nearly equal size; *hypopharyngeals* falciform and beset with pauciserial teeth; *branchial filaments* reduced and mostly confined to the second branchial arch.

Respiration supplemented by a pair of bladder-like sacks developed behind the head (one on each side of the nape), having "thin, semi-transparent, membranous parietes" and receiving a portion of the "blood contained in the branchial artery" for aërication.*

The family has but one genus, viz:

AMPHIPNOUS Müller Abhandl. Akad. Wissensch. Berlin, 1839, p. 246,† 1841=*Ophichthys Swainson*, Nat. Hist. Fishes, etc., v. 2, pp. 196, 336, 1839 (not of Ahl, 1789)=*Pneumabranchnus McClelland*, Calcutta Journ. Nat. Hist., v. 5, p. 192? 1844.

Type *A. cuchia*, ex Buch.

The skeletons which have served for the present description have been extracted from dried specimens of the *A. cuchia*, for which I am indebted to W. L. Selater, esq., the assistant director of the Indian Museum of Calcutta.

The postcephalic bladders and branchial apparatus have been described and illustrated by Hyrtl (Denkschr. k. Akad. Wiss., (Wien.), Math. Nat. Cl., v. 14, pp. 39-45, pl. 1858.

* Das Herz des *Amphipnous* is kein Venenherz, wie das aller übrigen Fische, sondern ein *Cor arterioso-venosum*, wie jenes der Amphibien.—Hyrtl, *o. c.*, p. 42.

† The name *Amphipnous* occurs (op. cit.) on p. 246 (not 244), but the remarks on the *cuchia* commence on p. 244.